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Inflorescences of the Himalayan species of *Impatiens* (Balsaminaceae)

Shinobu AKIYAMA[a] and Hideaki OHBA[b]

[a]Department of Botany, National Science Museum, Tokyo, Amakubo 4–1–1, Tsukuba, 305–0005 JAPAN;
[b]University Museum, University of Tokyo, Hongo 7–3–1, Bunkyo-ku, Tokyo, 113–0033 JAPAN

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The shape of inflorescences of the Himalayan species of *Impatiens* was studied. Nine types were recognized: 1 to 6 are racemes while 7 to 9 do not fit for the typical racemose inflorescence. The latter types were observed in Himalayan species but not in African ones. The correlations between the inflorescence type and the basic chromosome number were discussed.

Key words: *Impatiens*, inflorescence, Himalaya

Introduction

The Himalayan region is one of the centres of distribution of *Impatiens*. Hooker (1905) listed 63 species from the east Himalaya and presented keys to sections and species in his *An epitome of the British Indian species of* Impatiens. In this work he described a large number of new species accompanied by only few diagnostic characters and the distribution. Although Hara (1965, 1975) and Grey-Wilson (1989a, 1989b) improved Hooker's *Epitome*, the taxonomy of the Himalayan *Impatiens* is still incompletely resolved.

We have studied on the Sino-Himalayan *Impatiens*, and provided descriptions of the floral and vegetative features of 18 species occurring in East and Central Nepal (Akiyama et al. 1991). We revealed that though their flower forms are diverse the Himalayan species were classified into three groups by the differences in the basic number of chromosomes (Akiyama et al. 1992). We attempted to classify the flowers into three main types by the shape of lower sepals and their spurs (Akiyama et al. 1991). Two or more types of flowers are found in the species with the same basic number of chromosomes. This means that the differentiation of the flower types occurs independently from that of the basic number of chromosomes. We have noticed that the inflorescence is also diverse in the Himalayan species as pointed out by Hooker (1905). Hooker adopted the shape of inflorescences as one of the key characters to distinguish infrageneric groups, and distinguished racemose inflorescences from those with solitary or fascicled axillary pedicelate flowers. But the exact shape of inflorescences such as those of fascicled axillary pedicelate flowers is uncertain.

The feature of the inflorescences is regarded as one of the significant characters to distinguish the genera in some families (e.g., Hutchinson 1964). It is expected that the shape of the inflorescences gives data to establish the infrageneric taxa of the Himalayan *Impatiens*. We observe the inflorescences morphologically to clarify their shape and to discuss the correlation with the basic numbers of chromosomes and also the type of flowers.

Materials and methods

We observed the well developed inflorescences of 39 species of *Impatiens* collected from various localities in the Himalaya. The specific delimitation followed Hara (1979) and Akiyama et al.

Table 1. Type of inflorescence, shape of lower sepal and chromosome number of the Himalayan *Impatiens*

Species	Type of inflorescence*	Shape of lower sepal**	Chromosome number***
I. amplexicaulis	1b	N(c)	
I. arguta	4	B(c)	20
I. bajurensis	7	S	
I. balfourii	1a	B(c)	
I. bicolor	1b	B(c)	
I. bicornuta	3	S	18bi
I. cymbifera	1a	B(c)	18bi
I. decipiens	5	N(t)	
I. discolor	2b	B(c)	20
I. drepanophora	1a	N(tb)	
I. exilis	4	N(t)	28
I. falcifer	8	N(t)	14
I. gamblei	2b	B(c)	
I. glauca	9	B(c)	
I. graciliflora	3	N(t)	
I. harae	3	B(c)	18bi
I. hobsonii	2a	B(c)	
I. infundibularis	4	N(t)	
I. insignis	1a	B(t)	
I. jurpia	2a, b	B(c)	
I. leptoceras	1a	N(t)	
I. longipes	2a	N(t)	
I. mallae	1b	N(tb)	
I. occultans	6	N(sl)	18bi
I. pradhanii	3	S	18bi
I. puberula	5	B(t)	20
I. racemosa	1a, b	N(t)	18bi
I. radiata	3	N(t)	18bi
I. scabrida	7	B(c)	14
I. scullyi	1a	N(tb)	18
I. serrata	8	N(sl)	14
I. spirifer	5	B(c)	
I. stenantha	1b	N(tb)	
I. sulcata	3	B(c)	18bi
I. sunkoshiensis	1a, b	N(c)	18bi
I. tripetala	4	S	
I. uncipetala	7	B(t)	
I. urticifolia	2a	B(c)	18bi
I. wallichii	2a, b	B(c)	

*See Figure 2.

**See Figure 1.

***bi has bimodal karyotype.

(1991) principally. These species were listed in Table 1. Observations were done under a binocular microscope with a camera lucida. Schematic illustration was prepared based on the sketches. Terms used in this paper are shown in Figs. 1 and 2.

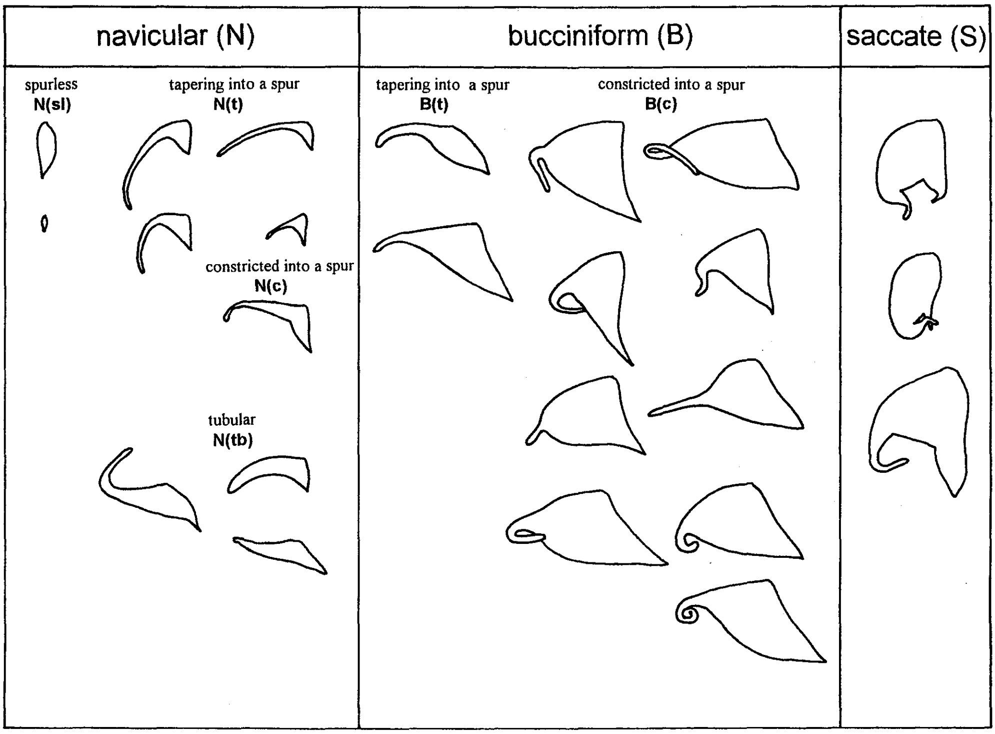

Fig. 1. Shape of the lower sepals of Himalayan *Impatiens*.

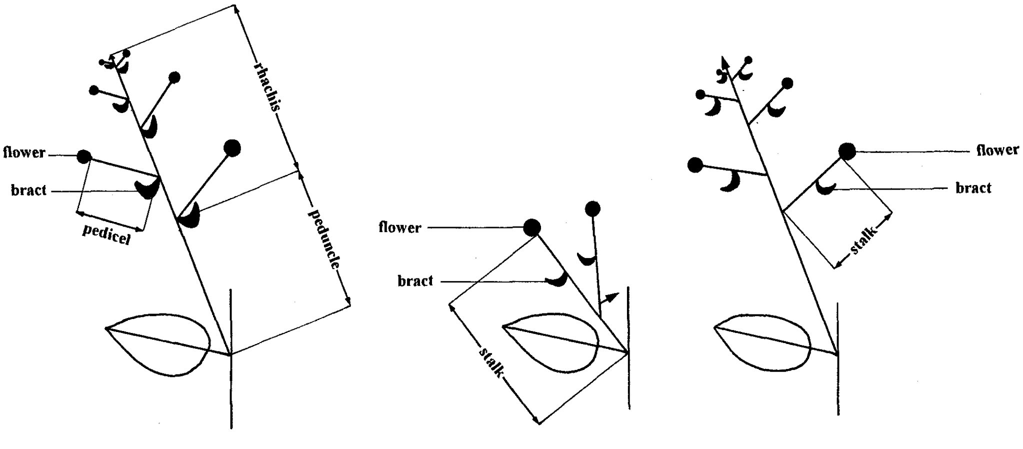

Fig. 2. Terms used in this paper.

Results

Nine types of inflorescences were distinguished in the Himalayan *Impatiens* mainly based on the position of bracts, the length and direction of peduncles, rhacheae and pedicels, and the number of flowers.

(1) Ascending racemose inflorescence (Figs. 3-1a and 1b)

Impatiens balfourii, I. cymbifera (Fig. 4b), *I. drepanophora, I. insignis, I. leptoceras, I. racemosa* (Fig. 4a), *I. scullyi* and *I. sunkoshiensis* have typical racemose inflorescences with ascending straight peduncles and rhacheae, and many flowers with bracts at the base of pedicels (Fig. 3-1a). This inflorescence is called type 1a. Among them *I. racemosa* and *I. sunkoshiensis* usually have many flowers but sometimes reduce the number of flowers to two or three (Fig. 3-1b). *Impatiens amplexicaulis, I. bicolor, I. mallae*, and *I. stenantha* have also typical racemes but with a few flowers (Fig. 3-1b). This inflorescence is called type 1b.

(2) Pendulous racemose inflorescence (Figs. 3-2a and 2b)

Impatiens hobsonii, I. jurpia, I. longipes, I. urticifolia (Fig. 4c), and *I. wallichii* (Fig. 5a) have also typical many-flowered racemose inflorescences with bracts at the base of pedicels but the peduncles and racheae are pendulous (Fig. 3-2a). This inflorescence is called type 2a. Among them *I. jurpia* and *I. wallichii* (Fig. 5b) usually have many flowers but sometimes reduce the number of flowers to three or two. *Impatiens discolor* (Fig. 4d) and *I. gamblei* have also few-flowered pendulous racemose inflorescences with bracts at the base of pedicels, but the peduncles and racheae are short (Fig. 3-2b). This inflorescence superficially looks like a corymb, and is called type 2b. In *I. wallichii* (and rarely in *I. urticifolia*) the recaulescent displacement of some bracts is found.

(3) Interrupted racemose inflorescence (Fig. 3-3)

Impatiens bicornuta (Fig. 5c), *I. graciliflora, I. harae, I. pradhanii, I. radiata* (Fig. 5d), and *I. sulcata* have a long ascending straight peduncle and a rhachis with almost wholed pedicels in several layers and many flowers. The bracts are located at the base of pedicels. This inflorescence is racemose but the pedicels are not equally situated throughout and gather in several layers, so that it looks like verticillate. This inflorescence is called type 3.

(4) Fascicled flowers (Fig. 3-4)

Impatiens arguta (Fig. 6a), *I. exilis, I. infundibularis*, and *I. tripetala* have a few flowers on axils. Each pedicel is subtended by a bract. Because a very short peduncle and a rhachis are recognized, this is undoubtedly a raceme with a very short peduncle and a rhachis. This inflorescence is called type 4.

(5) Solitary flower without a middle bract (Fig. 3-5)

Impatiens puberula (Fig. 6b), *I. spirifer*, and *I. decipiens* have a solitray flower on axils. Though it looks like bractless, a bract is evidently situated at the base of pedicel. Moreover a very short axis is observed below the pedicel and a small bud is also at the opposite side of the bract (Figs. 7b, 8a). This axis, though it is extremely short, appears to be the peduncle. This is a reduced racemose inflorescence having a very short peduncle with one axillary bracteate flower and an undeveloped terminal bud at the opposite side of the bract. This inflorescence is called type 5.

Impatiens decipiens has two flowers on axils occasionally. In this case the second flower is situated at the opposite side of the bract of the first flower and also a small bud is located at the opposite side of the bract of the second flower. Even in this case it appears that the inflorescence has a short

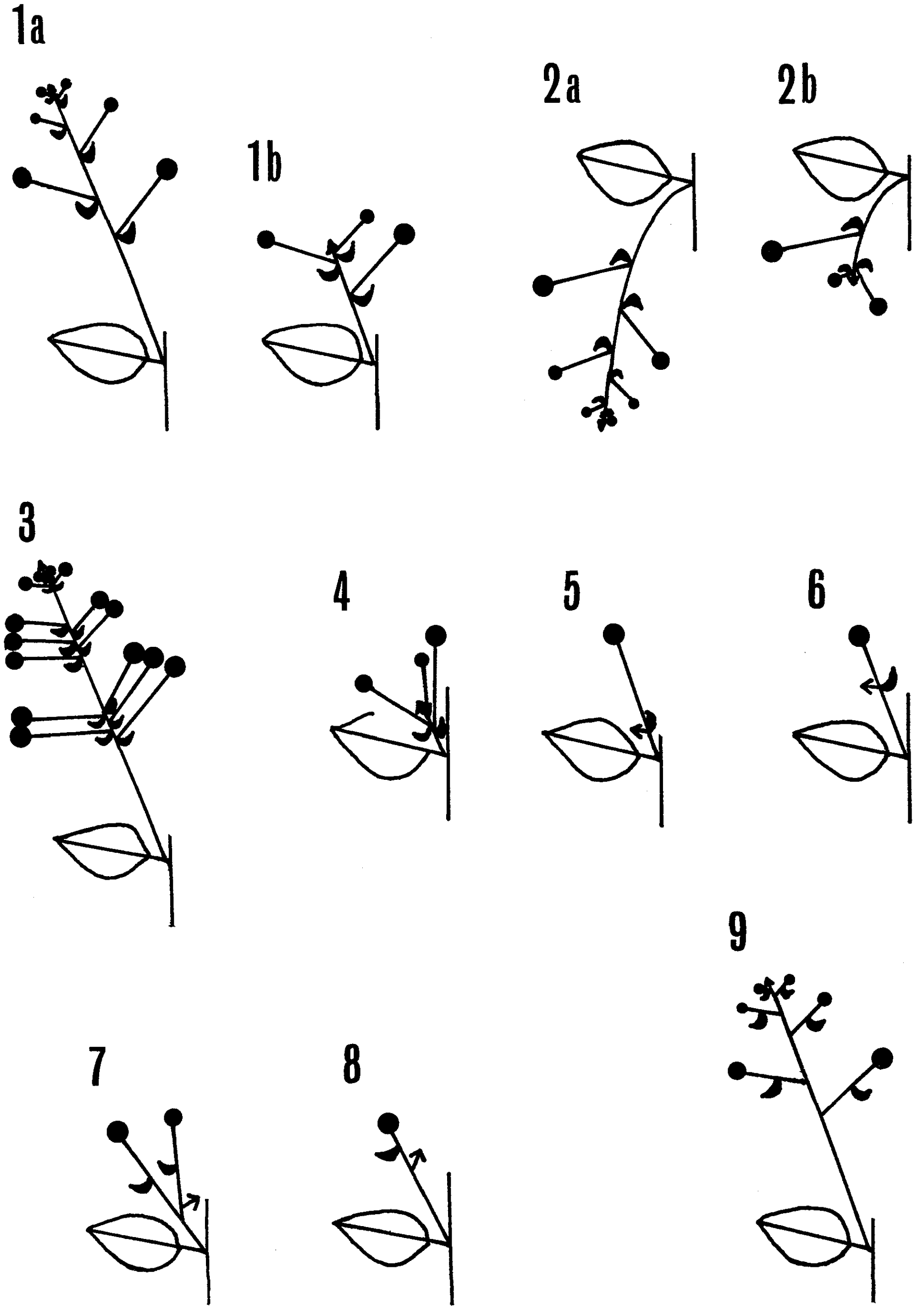

Fig. 3. Various types of inflorescences in *Impatiens*. 1a. Ascending raceme with many flowers. 1b. Ascending raceme with a few flowers. 2a. Pendulous raceme with many flowers. 2b. Pendulous raceme with a few flowers. 3. Interrupted raceme. 4. Fascicled flowers. 5. Solitary flower with a basal bract. 6. Solitary flower with a middle bract (1). 7. A few flowers with middle bract. 8. Solitary flower with a middle bract (2). 9. Many flowers with middle bracts.

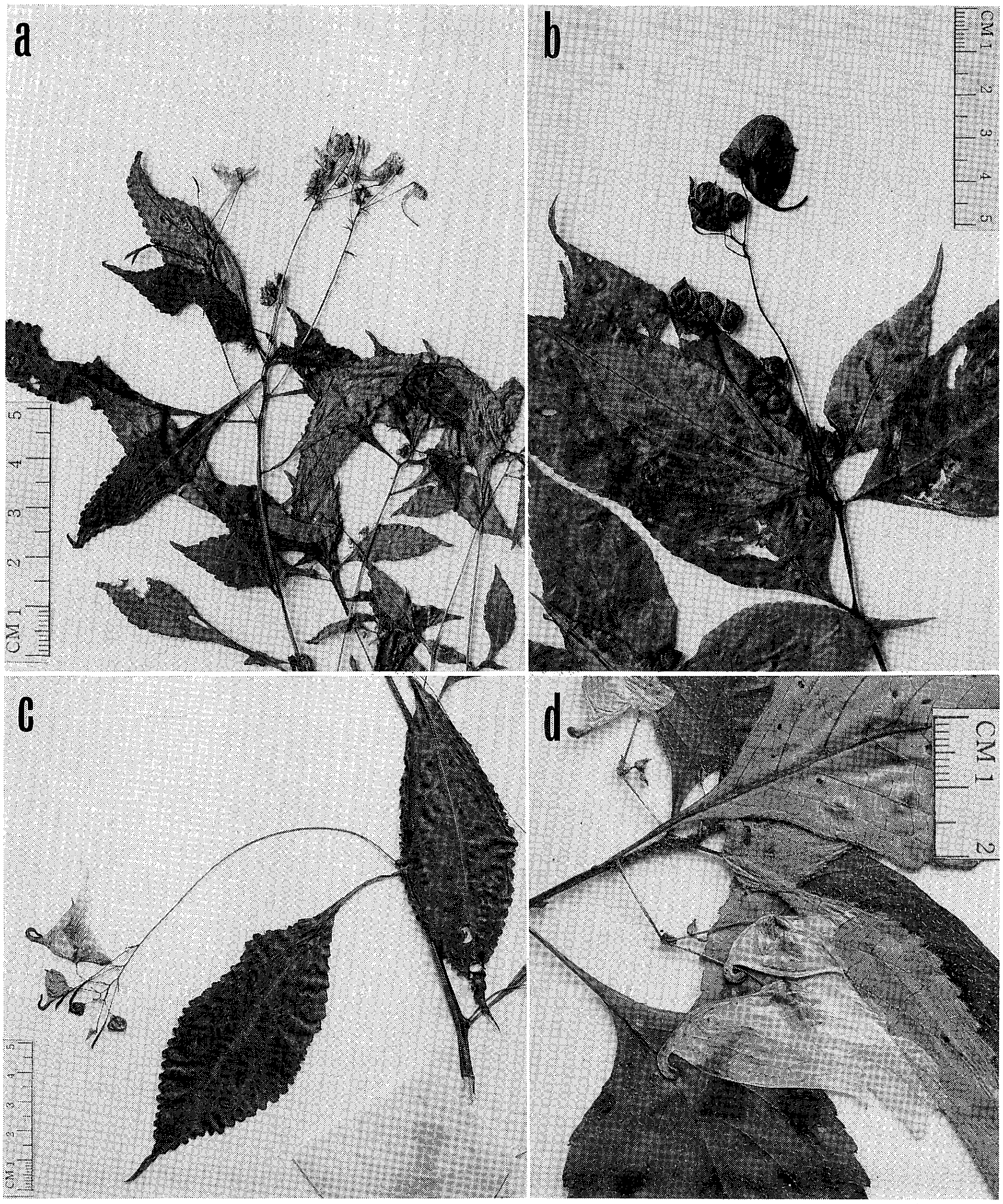

Fig. 4. Inflorescences of *Impatiens* (1). a. *I. racemosa*. b. *I. cymbifera*. c. *I. urticifolia*. d. *I. discolor*.

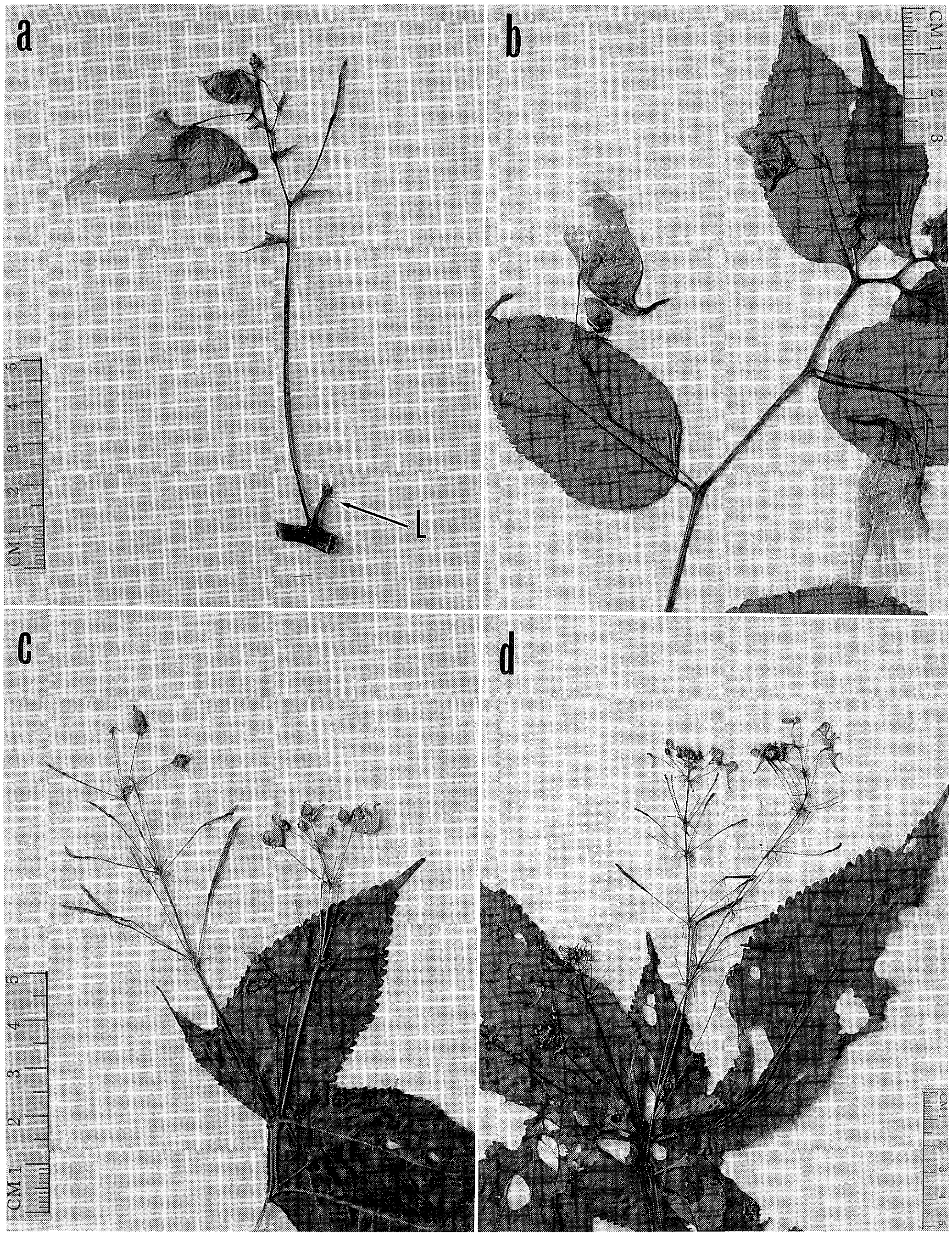

Fig. 5. Inflorescences of *Impatiens* (2). a and b. *I. wallichii*. c. *I. bicornuta*. d. *I. radiata*. L: Subtending leaf (partly removed).

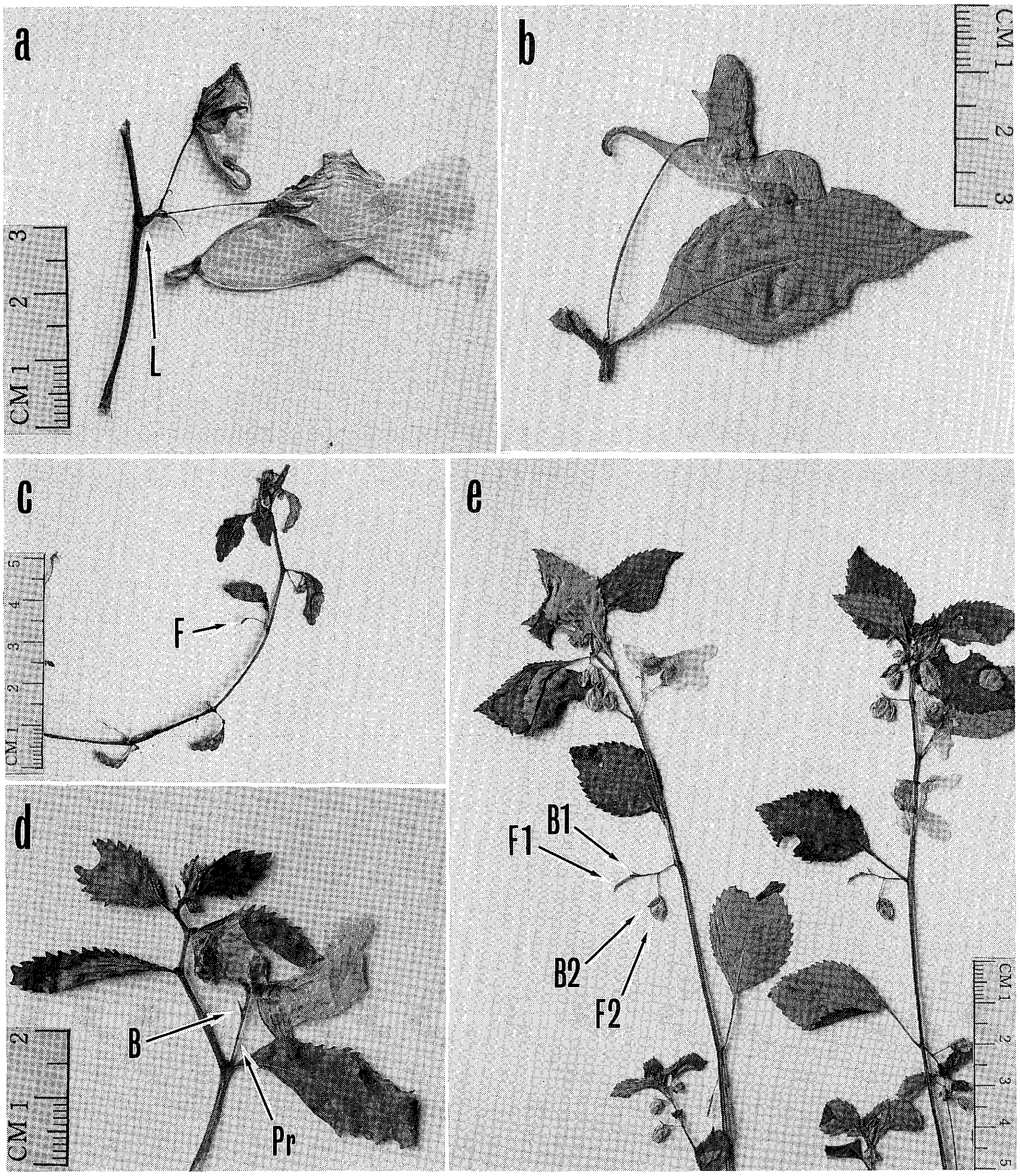

Fig. 6. Inflorescences of *Impatiens* (3). a. *I. arguta*. b. *I. puberula*. c. *I. occultans*. d. *I. falcifer*. e. *I. serrata*. B: Bract. B1: Bract at the base (or middle) of the pedicel of the first flower. B2: Bract of the second flower. F: Flower. F1: First flower. F2: Second flower. L: Subtending leaf (partly removed). Pr: Projection.

peduncle with two bracteate flowers and that the small bud represents the apical part of the rhachis. This inflorescence is also included in type 5.

(6) Solitary flower with a middle bract (1) (Fig. 3-6)

Impatiens occultans (Fig. 6c) has a solitary stalked-flower on axils. A bract is situ-

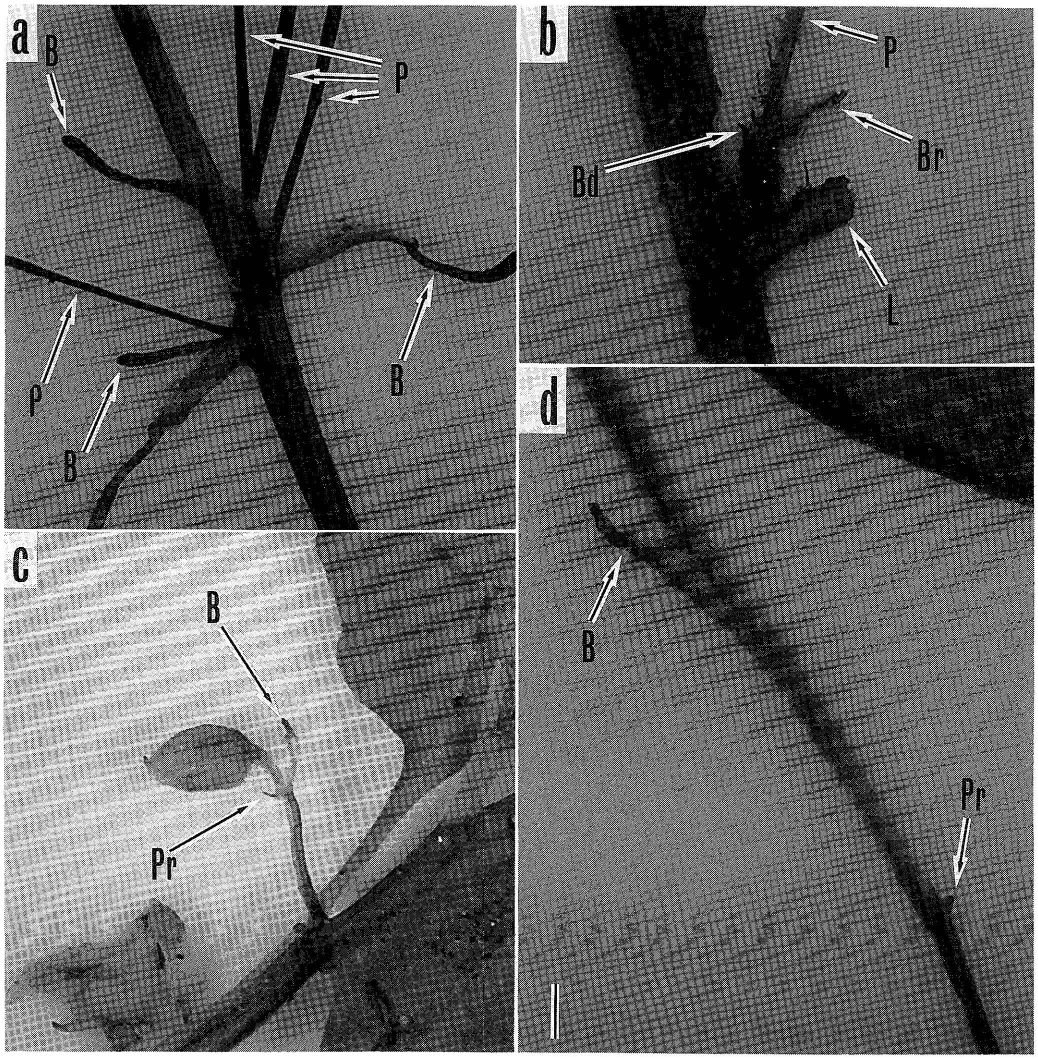

Fig. 7. Inflorescences of *Impatiens* (4). a. *I. radiata*. b. *I. puberula*. c. *I. occultans*. d. *I. falcifer*. B: Bract. Bd: Bud. L: Subtending leaf (partly removed). P: Pedicel. Pr: Projection. Bar indicates 1 mm for all.

ated at the middle portion of the stalk. A minute projection is also observed at the opposite side of the bract (Fig. 7c). In rare case the inflorescence bears two flowers but lacks any projections. In this case the second flower is located at the same position of the projection. It is considered that the proximal part of the stalk (the lower part of the stalk from the bract-attached point) is the peduncle and that the distal part is the pedicel. The small projection is regarded as a vestigial growing point of the rhachis. So that this is a reduced racemose inflorescence with a solitary flower as in the case mentioned in (5) but with a little elongated peduncle. This inflorescence is separated from the preceding one as type 6.

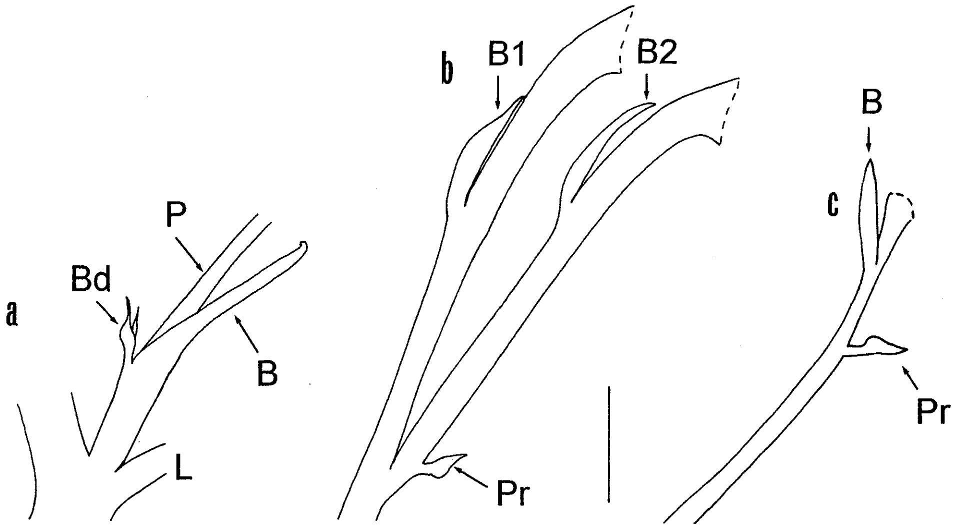

Fig. 8. Inflorescences of *Impatiens* (5). a. *I. spirifer*. b. *I. scabrida*. c. *I. falcifer*. B: Bract. B1: Bract of the first flower. B2: Bract of the second flower. Bd: Bud. L: Subtending leaf (partly removed). P: Pedicel. Pr: Projection. Bar indicates 3 mm for all.

(7) A few flowers with middle bracts (Fig. 3-7)

Impatiens bajurensis, *I. scabrida* (Fig. 8b), and *I. uncipetala* have an axillary inflorescence with a few (usually two, rarely one) stalked-flowers. The first flower has a bract at the middle portion of the stalk. The second flower's stalk attaches to the stalk of the first flower, and the position is always lower than the bract-attached point of the stalk. The stalk of the second flower has a minute projection at the part lower than the bract-attached point. If the inflorescence has three flowers, the third flower is situated at the position of the projection instead of it. The lower part of the stalk might be considered as a peduncle by means of the position of the bract and the succeeding flower. However, at present it is difficult to detect the branching pattern but considered that this is not racemose. This inflorescence is called type 7.

(8) Solitary flower with a middle bract (2) (Fig. 3-8)

Impatiens falcifer (Fig. 6d) and *I. serrata* (Fig. 6e) have a solitary stalked-flower on axils and a bract which is situated at the middle portion of the stalk. Usually a minute projection is observed, and the position is always lower than the bract (Figs. 6d, 7d, 8b). Occasionally both species have an axillary inflorescence with two flowers. In this case the second flower is situated at the position of the projection instead of it (Figs. 6e, 8c). It is considered that this is the same branching pattern as the case mentioned in (7) though the number of flowers is reduced to only one. This inflorescence is called type 8.

(9) Many flowers with middle bracts (Fig. 3-9)

Impatiens glauca has a many-flowered inflorescence on axils. The stalked-flowers are arranged spirally on the rhachis as in *I. racemosa*. Each stalk of the flowers has a bract at the middle portion. At a glance it looks like a raceme but the position of the bract is not fit for typical racemose inflorescence. This inflorescence is named type 9.

Discussions

From our observation it is cleared that types 1 to 6 are racemes while types 7, 8 and 9 are not fit for typical racemose inflorescence. Hooker (1905) adopted the shape of inflorescences as one of the key characters to distinguish infrageneric groups. He distinguished two groups; "inflorescence racemose" vs. "inflorescence of solitary or fascicled axillary pedicelled flowers." It becomes clear that "inflorescence of fascicled axillary pedicelled flowers" is type 4 and that "inflorescence of solitary flower" types 5 and 6. All of these types fall into the variations of racemose inflorescence.

Grey-Wilson (1980) wrote: "The inflorescence types observed in African species are to be found in India, and Asia, indeed no further types occur in the genus..." It is remarkable that in African *Impatiens* all of the inflorescence types fall into the variations of racemes, and the inflorescence types with the middle bract (i.e. types 7, 8 and 9), which were observed in Himalayan *Impatiens*, has been not found in the African species. Therefore, inflorescences are more diverse in Himalayan species than in African species.

The correlation between the inflorescence type and the chromosome numbers and karyotype were found. In *Impatiens* the species with 2n=18 choromosomes (both mono- and bimodal karyotypes) are more common than those with the other numbers in central and east Nepal, and it is suggested that these species represent a natural assemblage (Akiyama et al. 1992). These species have racemose inflorescences; belonging to 1, 2a, 3 and 6 types. These inflorescences have elongate peduncles and, except type 6, elongate rhachis with many or a few flowers. The type 1 is the most typical in raceme, so that the species with 2n=18 chromosomes and the type 1 might be ancestral. Type 2b with short rhachis and a few flowers is found in *I. discolor* with 2n=20 chromosomes. Types 4 and 5 with extremely short peduncles are found in *I. exilis* (2n=28), *I. arguta* (2n=20), and *I. puberula* (2n=20). The species with 2n=20 chromosomes have inflorescences belonging to types 2b, 4 and 5. Type 4 is regarded as the inflorescence with reduced peduncle and rhachis of type 2, and type 5 is regarded as the inflorescence with reduced number of flowers of type 4. Therefore the species with 2n=20 chromosomes might represent another natural assemblage. *Impatiens exilis* with 2n=28 chromosomes is unique among the Himalayan species because it has fusiform fruits (Hooker 1905) and the lateral united petals with the upper lobe similar to the lower in the shape and size (Akiyama et al. 1991), and 2n=28 chromosomes (Akiyama et al. 1992).

The species with 2n=14 chromosomes have the inflorescences belonging to types 7 and 8. Type 8 is regarded as the inflorescence with reduced number of flowers of type 7. So these species also might represent another natural assemblage. The position of the middle bracts in types 7, 8 and 9 is interesting and more detailed studies are needed to clear this morphology. The true feature of inflorescence is very difficult to detect because in some cases the displacement of bract is happened.

In *Impatiens* the shape of lower sepals and their spurs mainly contributes to the shape of the flowers. The lower sepals is principally classified into 3 types, navicular, bucciniform and saccate according to the shape (Akiyama et al., 1991) (Fig. 1). *Impatiens serrata* and *I. occultans* have spurless navicular lower sepal but the inflorescence type is different, type 8 in *I. serrata* vs. type 6 in *I. occultans*. Navicular lower sepals with spur are found in *I. racemosa, I. radiata, I. exilis* and *I. falcifer*, but the inflorescence of *I. falcifer* is type 8 and different from other racemose types (1a, b, 3 and 4). The same relation is observed in bucciniform and saccate type lower sepals. The shape of lower sepals hardly correlates with the inflorescence type.

The infrageneric classification of *Impatiens* has not yet been established. As mentioned in the introduction the shape of lower sepals and the basic number of chromosomes do not well correlate. Moreover from this study it becomes clear that the correlation between the shape of lower sepals and the inflorescence type is also weak. On the other hand the correlation between the inflorescence type and the basic chromosome number is considerable. It is suggested that the inflorescence type might be one of important characters to recognize the infrageneric natural assemblages reflecting their phylogeny.

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References

Akiyama S., Ohba H. and Wakabayashi M. 1991. Taxonomic notes of the East Himalayan species of *Impatiens*. Studies of Himalayan *Impatiens* (Balsaminaceae) (1). *In*: Ohba H. and Malla S. B. (eds.), The Himalayan Plants, **2**: 67–94. University of Tokyo Press, Tokyo.

——, Wakabayashi M. and Ohba H. 1992. Chromosome evolution in Himalayan *Impatiens* (Balsaminaceae). Bot. J. Linn. Soc. **109**: 247–257.

Grey-Wilson C. 1980. *Impatiens* of Africa. 235 pp. A. A. Balkema, Rotterdam.

—— 1989a. The *Impatiens bicornuta* and its allies. Studies in Balsaminaceae: VII. Kew Bull. **44**: 61–66.

—— 1989b. The *Impatiens jurpia* complex. Studies in Balsaminaceae: X. Kew Bull. **44**: 115–122.

Hara H. 1965. New or noteworthy flowering plants from Eastern Himalaya (4). J. Jpn. Bot. **40**: 97–103.

—— 1975. Balsaminaceae: *In*: Ohashi, H. (compiled), Flora of Eastern Himalaya, third rep., 78–80. University of Tokyo Press, Tokyo.

—— 1979. Balsaminaceae: *In*: Hara, H. and Williams, L.H.J. (eds.), An Enumeration of the Flowering Plants of Nepal, **2**: 78–80.

Hooker J. D. 1905. An epitome of the British Indian species of *Impatiens*. Rec. Bot. Surv. Ind. **4**: 1–58.

Hutchinson J. 1964. The Genera of Flowering Plants, 1st ed. Oxford University. Press, London.

Appendix

Specimens examined of *Impatiens* species (all deposited in TI).

I. amplexicaulis Edgew.

Nepal. H. Kanai 720737; H. Ohashi et al. 770670; H. Ohashiet al. 772317; S. Noshiro 9154522; H. Kanai & P.R. Shakya 672491; P.R. Shakya & Adhikari 662.

I. arguta Hook.f. & Thomson

Nepal. H. Ohashi et al. 771288; H. Ohba et al. 8520416; H. Ohba et al. 9120029; H. Ohba et al. 9120030; H. Ohba et al. 9120045; S. Noshiro et al. 9241070; S. Noshiro et al. 9241088; S. Noshiro et al. 9241103; F. Miyamoto et al. 9584017; F. Miyamoto et al. 9584068.

I. bajurensis S.Akiyama & H.Ohba

Nepal. M. Suzuki et al. 9171054.

I. balfourii Hook.f.

Naturalized or cultivated in Japan. M. Nakao, 21–27 Sept. 1998; M. Togashi, 12 Aug. 1970.

I. bicolor Royle

Nepal. C. Wright 46.

I. bicornuta Wall.

Nepal. M. Suzuki et al. 8810824; M. Suzuki et al. 8810877; M. Suzuki et al. 8811405; M. Suzuki et al. 8812592; M. Suzuki et al. 8860507; M. Suzuki et al. 8881085; F. Miyamoto et al. 9584016; H. Ohashi et al. 771436; H. Ohba et al. 8310204; H. Ohba et al. 8311069; H. Ohba et al. 8320726; H. Ohba et al. 8332089; H. Ohba et al. 8350197; H. Ohba et al. 8520260; H. Ohba et al. 8520269; H. Ohba et al. 8520389; H. Ohba et al. 8531273; H. Ohba et al. 8531297; H. Ohba et al. 8531298; H. Ohba et al. 8571363; H. Ohba et al. 8571821; H. Ohba et al. 8572281; M. Suzuki et al. 8842104; M. Suzuki et al. 8860492; M. Suzuki et al. 8881289; M. Minaki et al. 9011010; S. Noshiro 9154515; M. Suzuki et al. 9170230; M. Suzuki et al. 9170251; M. Suzuki et al. 9170886; M. Suzuki et al. 9171001; F.Miyamoto et al. 9420241; F.Miyamoto et al. 9420262; F.Miyamoto et al. 9420276.

I. cymbifera Hook.f.

Nepal. H. Ohashi et al. 773620; H. Ohashi et al. 773622; H. Ohba et al. 8320599; H. Ohba et al. 8520275; H. Ohba et al. 8571782; H. Ohba et al. 8571866; M. Suzuki et al. 8860623; M. Suzuki et al. 8881254; F.Miyamoto et al. 9420247; Stainton et al. 8580; H. Hara et al. 69896; K.N. Sharma E58; H.

Kanai et al. 674720; H. Kanai et al. 672865. Sikkim. H. Hara & K.C. Pradhan, 13 Sept. 1964.

I. decipiens Hook.f.

Sikkim. H. Hara et al. 69858; H. Hara et al. 69859; H. Hara et al., 17 June 1960.

I. discolor DC.

Nepal. H. Ohashi et al. 771264; H. Ohashi et al. 771446; H. Ohashi et al. 771480; H. Ohashi et al. 771647; H. Ohashi et al. 773069; H. Ohashi et al. 774502; H. Ohba et al. 8520262; H. Ohba et al. 8520270; H. Ohba et al. 8520390; H. Ohba et al. 8520413; H. Ohba et al. 8531343; H. Ohba et al. 8571404; H. Ohba et al. 8571684; H. Ohba et al. 8571722; H. Ohba et al. 8571818; H. Ohba et al. 8571823; H. Ohba et al. 8572452; H. Ohba et al. 8572459; H. Ohba et al. 8572483; M. Suzuki et al. 8881819; M. Suzuki et al. 8881866; M. Suzuki et al. 8881970; F. Miyamoto et al. 9584026.

I. drepanophora Hook.f.

Sikkim. H. Hara et al. 276; H. Hara et al. 310; H. Hara et al. 69885.

I. exilis Hook.f.

Nepal. H. Ohashi et al. 770305; H. Ohashi et al. 771394; H. Ohashi et al. 771895; H. Ohashi et al. 773398; H. Ohashi et al. 774218; H. Ohashi et al. 774632; H. Ohba et al. 8320547; H. Ohba et al. 8331374; H. Ohba et al. 9120406; H. Ohba et al. 9120411.

I. falcifer Hook.f.

Nepal. H. Ohashi et al. 770560; H. Ohashi et al. 771433; H. Ohashi et al. 772675; H. Ohashi et al. 773623; H. Ohashi et al. 774952; H. Ohashi et al. 775275; H. Ohba et al. 8320608; H. Ohba et al. 8520274; H. Ohba et al. 8520405; H. Ohba et al. 8531342; H. Ohba et al. 8531378; H. Ohba et al. 8571788; H. Ohba et al. 8572498; H. Ohba et al. 8581485; M. Suzuki et al. 8820497; M. Suzuki et al. 8850345; M. Suzuki et al. 8850751; M. Suzuki et al. 8860373; M. Suzuki et al. 8880454; M. Suzuki et al. 8880461; M. Minaki et al. 9010109; M. Minaki et al. 9020582; M. Minaki et al. 9020596; M. Minaki et al. 9080115; H. Ohba et al. 9110452; H. Ohba et al. 9120401; S. Noshiro 9154521; S. Noshiro 9154536; F. Miyamoto et al. 9584035; F. Miyamoto et al. 9584267.

I. gamblei Hook.f.

Nepal. H. Kanai et al. 721126; H. Kanai et al. 723230. Darjeeling. H. Hara, 16 Sept. 1964; H. Kanai et al. 723232; H. Haraet al. 69890; H. Hara et al. 69891; H. Kanai et al. 721303; H. Hara et al. 69893; H. Hara et al. 69892; H. Kanai et al. 723231.

I. glauca Hook. f. & Thomson

Nepal. M. Suzuki et al. 9170555.

I. graciliflora Hook.f.

Nepal. S. Noshiro et al. 9241024; S. Noshiro et al. 9241084; S. Noshiro et al. 9241093; S. Noshiro et al. 9241094; S. Noshiro et al. 9241109; L.H.J. Williams 403; Williams & Stainton 8526. Darjeeling. H. Hara 6300487; H. Hara & H. Ohba 723218; H. Kanai et al. 721549; H. Kanai et al. 723215; H. Kanai et al. 723216; H. Kanai et al., 7 May 1960; G. Murata et al. 2990; H. Ohashi et al. 723217.

I. harae H. Ohba & S. Akiyama

Nepal. F.Miyamoto et al. 9420286; F.Miyamoto et al. 9440176.

I. hobsonii Hook.f.

Nepal. J.D.A. Stainton 828.

I. infundibularis Hook.f.

Bhutan. A.J.C. Grierson & D.G. Long 2158

I. insignis DC.

Nepal. M. Suzuki et al. 8881791; H. Hara et al. 6300502; H. Hara et al. 6306723; H. Hara et al. 6306724; H. Hara et al. 6306725; H. Hara et al. 6306726; H. Hara et al., 30 Oct. 1963; H. Hara et al. 5 Nov. 1963; H. Hara & S. Kurosawa 6300501 H. Kanai & T.B. Shresta 672705; H. Kanai et al. 674699; Manandhar et al. 12915; H. Ohashi et al. 772736; A.D. Schilling 640; Williams & Stainton 8453; Unknown coll. 7458.

I. jurpia Buch.-Ham.

Nepal. H. Hara et al. 6300490. Darjeeling. H. Hara 6306727; H. Hara & M. Togashi 2991; H. Kanai et al. 721576; H. Kanai et al. 723209; H. Ohashi et al. 723207; H. Ohashi et al. 723208. Sikkim. H. Hara et al. 69869.

I. leptoceras DC.

Nepal. H. Hara et al. 6306728; H. Kanai & T.B. Shrestha 672694.

I. longipes Hook.f. & Thomson

Darjeeling. H. Hara et al. 69868.

I. mallae S. Akiyama, H. Ohba & M. Suzuki

Nepal. M. Suzuki et al. 8821106.

I. occultans Hook.f.

Nepal. H. Kanai et al. 721860; H. Ohashi et al. 770637; H. Ohashi et al. 770732; H. Kanai Y. Tateishi 770948; H. Ohashi et al. 772219; H. Ohba 772597; H. Ohashi et al. 773661; H. Ohba 775212; H. Ohba et al. 8320622; H. Ohba et al. 8331975; H. Ohba et al. 8520179; H. Ohba et al. 8520242; H. Ohba et al. 8520278; M. Wakabayashi et al. 8520324; H. Ohba & S. K. Wu 8530644; H. Ohba et al. 8530703; H. Ohba et al. 8531008; K. R. Rajbhandari 8531199; H. Ohba et al. 8531381; H. Ohba et al. 8570653; H. Ohba et al. 8570746; H. Ohba et al. 8571019; H. Ohba et al. 8571790; H. Ohba et al. 8571909; H. Ohba et al. 8571919; H. Ohba et al. 8572157; H. Ohba et al. 8572427; H. Ohba & S. K. Wu 8580614; H. Ohba et al. 8581287; M. Minaki et al. 9020826; H. Ohba et al. 9120311; H. Ohba et al. 9120397; F. Miyamoto et al. 9410244; F. Miyamoto et al. 9420074; F.Miyamoto et al. 9420165; F.Miyamoto et al. 9420233; F. Miyamoto et al. 9584036; F. Miyamoto et al. 9584111; Kanai & Malla 674758; J.D.A. Stainton 1420. Darjeeling. H. Kanai et al. 721412; H. Kanai et al. 723192.

I. pradhanii H.Hara

Nepal. H. Ohba et al. 8320520; H. Ohba et al. 8320598; H. Ohba et al. 8331704; H. Ohba et al. 8351176.

I. puberula DC.

Nepal. H. Ohashi et al. 773538; H. Ohba et al. 8310134; H. Ohba et al. 8320165; H. Ohba et al. 8320597; H. Ohba et al. 8320729; H. Ohba et al. 8330273; H. Ohba et al. 8520003; H. Ohba et al. 8520256; H. Ohba et al. 8530733; H. Ohba et al. 8531404; H. Ohba et al. 8571170; H. Ohba et al. 8571183; H. Ohba et al. 8571188; H. Ohba et al. 8571256; H. Ohba et al. 8571465; M. Suzuki et al. 8571653; M. Suzuki et al. 8580883; M. Suzuki et al. 8812593; M. Suzuki et al. 8842103; M. Suzuki et al. 8860585; M. Suzuki et al. 8860620; M. Suzuki et al. 8881041; M. Suzuki et al. 8881260; M. Suzuki et al. 8881274; M. Suzuki et al. 8881829; M. Suzuki et al. 8881944; H. Ohba et al. 9120044; H. Ohba et al. 9120057; H. Ohba et al. 9120059; S. Noshiro et al. 9241085; S. Noshiro et al. 9241087; F. Miyamoto et al. 9584007; F. Miyamoto et al. 9584062.

I. racemosa DC.

Nepal. H. Ohashi et al. 771266; H. Ohashi et al. 771614; H. Ohashi et al. 771937; H. Ohashi et al. 772952; H. Ohashi et al. 773629; H. Ohashi et al. 774146; H. Ohashi et al. 774549; H. Ohashi et al. 774675; H. Ohashi et al. 774836; H. Ohba et al. 8320246; H. Ohba et al. 8320586; H. Ohba et al. 8320609; H. Ohba et al. 8320727; H. Ohba et al. 8331644; H. Ohba et al. 8331736; H. Ohba et al. 8331764; H. Ohba et al. 8332044; H. Ohba et al. 8332067; H. Ohba et al. 8520258; H. Ohba et al. 8520259; H. Ohba et al. 8520267; H. Ohba et al. 8530750; H. Ohba et al. 8531272; H. Ohba et al. 8531296; H. Ohba et al. 8531300; H. Ohba et al. 8571042; H. Ohba et al. 8571185; H. Ohba et al. 8571259; H. Ohba et al. 8571336; M. Suzuki et al. 8571580; M. Suzuki et al. 8571631; H. Ohba et al. 8572145; H. Ohba et al. 8572275; H. Ohba et al. 8581443; M. Suzuki et al. 8810838; M. Suzuki et al. 8811473; M. Suzuki et al. 8821160; M. Suzuki et al. 8821267; M. Suzuki et al. 8860531; M. Suzuki et al. 8881086; M. Suzuki et al. 8881196; M. Suzuki et al. 8881302; M. Suzuki et al. 8881498; M. Suzuki et al. 8881830; M. Minaki et al. 9011018; M. Minaki et al. 9020332; M. Minaki et al. 9020333; H. Ohba et al. 9120409; S. Noshiro 9154504; S. Noshiro 9154505; S. Noshiro 9154518; M. Suzuki et al. 9170710; M. Suzuki et al. 9240046; M. Suzuki et al. 9240265; S. Noshiro et al. 9240526; S. Noshiro et al. 9240982; F.Miyamoto et al. 9410243; F.Miyamoto et al. 9420251; F.Miyamoto et al. 9420263; F.Miyamoto et al. 9440013; F. Miyamoto et al. 9584075; F. Miyamoto et al. 9584344.

I. radiata Hook.f.

Nepal. H. Ohashi et al. 770542; H. Ohashi et al. 770998; H. Ohashi et al. 773495; H. Ohashi et al. 774776; H. Ohashi et al. 775287; H. Ohba et al. 8320602; H. Ohba et al. 8331712; H. Ohba et al. 8520261; H. Ohba et al. 8520268; H. Ohba et al. 8530681; H. Ohba et al. 8531280; H. Ohba et al. 8531287; H. Ohba et al. 8531360; H. Ohba et al. 8571128; H. Ohba et al. 8571388; H. Ohba et al. 8571718; H. Ohba et al. 8571822; H. Ohba et al. 8572254; H. Ohba et al. 9120016; H. Ohba et al. 9120050; H. Ohba et al. 9120079; M. Suzuki et al. 9240275; F.Miyamoto et al. 9420278; F. Miyamoto et al. 9584053.

I. scabrida DC.

Nepal. H. Ohba et al. 8311019; H. Ohba et al. 8320479; H. Ohba et al. 8320576; H. Ohba et al. 8320735; H. Ohba et al. 8331156; H. Ohba et al. 8332122; H. Ohba et al. 8520266; H. Ohba et al. 8520415; H. Ohba et al. 8531344; H. Ohba et al. 8531382; H. Ohba et al. 8571737; M. Suzuki et al. 8881364; M. Suzuki et al. 8881449; M. Suzuki et al. 8881458; M. Suzuki et al. 8881778; M. Suzuki et al. 8881795; S. Noshiro 9154503; M. Suzuki et al. 9170299; M. Suzuki et al. 9170507; M. Suzuki et al. 9170590; M. Suzuki et al. 9170804; M. Suzuki et al. 9170907; M. Suzuki et al. 9170946; F. Miyamoto et al. 9420264.

I. scullyi Hook.f.

Nepal. H. Ohba et al. 8310232; H. Ohba et al. 8311065; H. Ohba et al. 8320518; H. Ohba et al. 8571452; M. Suzuki et al. 8571597; M. Suzuki et al. 8860608; M. Suzuki et al. 8881141; M. Suzuki et al. 8881429; M. Suzuki et al. 8881450; M. Suzuki et al. 8881529; M. Suzuki et al. 8881559; M. Suzuki et al. 8881710; S. Noshiro 9154506; M. Suzuki et al. 9170554; M. Suzuki et al. 9170957; F. Miyamoto et al. 9420261.

I. serrata Benth. ex Hook.f. & Thomson

Nepal. H. Ohba et al. 8571812; H. Ohba et al. 8580990; H. Ohba et al. 8581466; M. Suzuki et al. 9170231; M. Suzuki et al. 9170663; M. Suzuki et al. 9170959; M. Suzuki et al. 9170993; F.Miyamoto et al. 9420166; F.Miyamoto et al. 9420180; F.Miyamoto et al. 9420189; F.Miyamoto et al. 9420242.

I. spirifer Hook.f. & Thomson

Nepal. S. Noshiro et al. 9240987.

I. stenantha Hook.f.

Nepal. M. Suzuki et al. 8880424; H. Ohba et al. 9120042; H. Ohba et al. 9120058; H. Ohba et al. 9120402; H. Ohba et al. 9120410; H. Ohba et al. 9120415; M. Suzuki et al. 9240047; M. Suzuki et al. 9240276; S. Noshiro et al. 9240761; S. Noshiro et al. 9240797; S. Noshiro et al. 9240832; S. Noshiro et al. 9240997; S. Noshiro et al. 9241022; S. Noshiro et al. 9241086.

I. sulcata Wall.

Nepal. H. Ohba et al. 8310837; H. Ohba et al. 8320446; H. Ohba et al. 8320606; H. Ohba et al. 8330943; H. Ohba et al. 8331691; H. Ohba et al. 8331780; H. Ohba et al. 8331793; H. Ohba et al. 8520276; H. Ohba et al. 8531279; H. Ohba et al. 8571778; H. Ohba et al. 8571859; H. Ohba et al. 8572218; H. Ohba et al. 8572574; M. Suzuki et al. 8860963; M. Suzuki et al. 8881319; M. Suzuki et al. 9170232; M. Suzuki et al. 9170486; M. Suzuki et al. 9170680; M. Suzuki et al. 9170984; F. Miyamoto et al. 9420161; F.Miyamoto et al. 9420195; F. Miyamoto et al. 9584052; F. Miyamoto et al. 9584319.

I. sunkoshiensis S.Akiyama, H.Ohba & Wakabayashi

Nepal. H. Ohba et al. 8320603; H. Ohba et al. 8331731; H. Ohba et al. 8331765; H. Ohba et al. 8331781.

I. tripetala Roxb. ex DC.

Nepal. H. Hara et al. 6300496; H. Hara et al., 4 Nov. 1963; H. Kanai et al. 720981; H. Ohashi et al. 771074; H. Ohashi et al. 772756; H. Ohashi et al. 774013; H. Ohashi et al. 774018; H. Ohashi et al. 775362.

Bhutan. H. Kanai et al. 185; H. Kanai et al. 194; H. Kanai et al. 561; A.J.C. Grierson & D.G. Long 1428.

I. uncipetala C.B.Clarke ex Hook.f.

Nepal. H. Hara et al. 6306721; H. Hara et al. 6306722; H. Ohashi et al. 771180; H. Ohashi et al. 772940; H. Ohashi et al. 774134; H. Ohashi et al. 775444; H. Ohbaet al. 9120043; S. Noshiroet al. 9241023; S. Noshiroet al. 9241051. Darjeeling. H. Hara et al. 69894. Sikkim. H. Hara et al. 69895; H. Hara, 13 Sept. 1964.

I. urticifolia Wall.

Nepal. H. Ohashi et al. 770997; H. Ohashi et al. 771263; H. Ohashi et al. 773869; H. Kanai & Y. Tateishi 775206; H. Ohba et al. 8310249; H. Ohba et al. 8310312; H. Ohba et al. 8320187; H. Ohba et al. 8320601; H. Ohba et al. 8320604; H. Ohba et al. 8320701; H. Ohba et al. 8320703; H. Ohba et al. 8331766; H. Ohba et al. 8331782; H. Ohba et al. 8331976; H. Ohba et al. 8351477; H. Ohba et al. 8520151; H. Ohba et al. 8530409; H. Ohba et al. 8530435; H. Ohba et al. 8531308; H. Ohba et al. 8531377; M. Suzuki & N. Kurosaki 8570536; H. Ohba et al. 8570713; H. Ohba et al. 8571775; H. Ohba et al. 8572315; H. Ohba et al. 8580402; M. Suzuki et al. 8850385; M. Suzuki et al. 8860649; M. Suzuki et al. 8881270; M. Suzuki et al. 8881280; M. Suzuki et al. 8881283; H. Ohba et al. 9120051; H. Ohba et al. 9120065; H. Ohba et al. 9120113; H. Ohba et al. 9120122; S. Noshiro 9154520; M. Suzuki et al. 9170225; M. Suzuki et al. 9170640; F. Miyamoto et al. 9420196; F. Miyamoto et al. 9420238.

I. wallichii Hook.f.

Nepal. H. Kanai et al. 723222; F. Miyamoto et al. 9420163; F. Miyamoto et al. 9420193; F. Miyamoto et al. 9420232; F. Miyamoto et al. 9420240; F. Miyamoto et al. 9420279; F. Miyamoto et al. 9584060; F. Miyamoto et al. 9584088; Kanai & Malla 674756.

秋山　忍[a]，大場秀章[b]：ヒマラヤ産ツリフネソウ属の花序

ヒマラヤ産ツリフネソウ属の花序の外部形態を調べた．花序には9型がみとめられ，1から6は総状花序であり，7から9は典型的総状花序の範疇に入らない花序であった．この総状花序の範疇に入らない花序は，アフリカ産ツリフネソウ属ではみられない．花序型は染色体数との関連がみとめられ，ツリフネソウ属の属内分類群を確立するにあたり，花序型は重要な形質となりうる可能性が示唆された．

（[a]国立科学博物館植物研究部，
[b]東京大学総合研究博物館）